DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO

TR/DLTI/MATH/P-II/17

Test Booklet Series

TEST BOOKLET
GENERAL ABILITY TEST
(PART– II)
(Mathematics)

B

(Signature of the Candidate)

(Invigilator's Signature)

Time Allowed : 1 hour 30 minutes (One hour thirty minutes) **Maximum Marks : 60**

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE SCREENING TEST, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.**
3. This Test Booklet contains 60 items (questions). Each question, carrying 1 (one) mark only, has four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose ONLY ONE response for each item.
4. You have to mark all your responses by **Black Ball Point Pen only** on the separate Answer Sheet provided. See directions in the Answer Sheet.
5. All items carry equal marks.
6. Before you proceed to mark in the Answer Sheet the responses to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet.
7. After you have completed filling in responses on the Answer Sheet and the Screening Test is completed, you should handover the Answer Sheet to the Invigilator only. You are permitted to take the Test Booklet with you.
8. Sheets for rough work are appended on the Test Booklet at the end.
9. **Penalty for wrong answers :**
   (a) There will be four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
   (b) If a candidate gives more than one answer, it will be treated as a **Wrong Answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
   (c) If a question is left blank, i.e. no answer is given by the candidate, there will be **no penalty** for that question.

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Four options are given against each of the following questions. Select the best/correct option from among the four options and encode in the answer sheet by using **Black Ball Point Pen** only as per example given below :

Example : The capital of India is

(A) Delhi ● New Delhi

(C) Indraprastha (D) None of these

In all the questions symbols have their usual meanings.

1. If α and β be real and $|\sin(\alpha+i\beta)| = 1$, then

   (A) $\cosh 2\beta - \cos 2\alpha = 2$

   (B) $\cos 2\beta - \cosh 2\alpha = 2$

   (C) $\sinh 2\beta - \sin 2\alpha = 2$

   (D) $\sin 2\alpha - \sinh 2\alpha = 2$

2. The general value of $(i)^i$

   (A) $e^{(2n+1)\pi}$

   (B) $e^{(2n+\frac{1}{2})\pi}$

   (C) $e^{-(2n+\frac{1}{2})\pi}$

   (D) $e^{-(2n-\frac{1}{2})\pi}$

3. If a, b, c be positive and a+b+c=1, then the least value of $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}$ is

   (A) 1

   (B) 8

   (C) $\frac{1}{9}$

   (D) 9

4. If A is a square matrix and A^T is its transpose, then $A + A^T$ will be

   (A) inverse matrix

   (B) skew-symmetric matrix

   (C) symmetric matrix

   (D) unit matrix

5. The system of equations $x+2y+3z=1$, $2x+y+3z=2$, $5x+5y+9z=4$ have

   (A) no solution

   (B) unique solution

   (C) infinitely many solutions

   (D) None of these

6. A mapping $f : N \to N$ is defined by $f(x)=2x \ \forall x \in N$, the f is

   (A) one-one into mapping

   (B) one-one onto mapping

   (C) many-one into mapping

   (D) many-one onto mapping

7. If $G = \{1, -1, i, -i\}$ is a multiplicative group, then the order of $-i$ is

(A) one

(B) two

(C) three

(D) four

8. Which of the following statement is false ?

(A) Every field is an integral domain.

(B) Every finite integral domain is a field.

(C) Every field is a ring.

(D) Every integral domain is a field.

9. Which of the following statement is correct ?

(A) Every subset of linearly independent set is linearly independent.

(B) Every superset of a linearly independent set is linearly independent.

(C) Every subset of a linearly dependent set is linearly dependent.

(D) Every subset of a linearly dependent set is linearly independent.

10. Let V and W be vector spaces over R. $T : V \to W$ be a mapping. Then T is a linear transformation if and only if

(A) $T(x+y)=T(x)+T(y), \ \forall x, y \in V$

(B) $T(\alpha x)=\alpha T(x), \ \forall x \in V, \ \alpha \in R$

(C) $T(\alpha x+\beta y) = \alpha T(x)+\beta T(y), \ \forall x, y \in V, \ \alpha, \beta \in R$

(D) $T(x-y) = T(x) - T(y), \ \forall x, y \in V$

11. If $\hat{x}$ and $\hat{y}$ are two unit vectors and θ is the angle between them, $|\hat{x}-\hat{y}|$ is equal to

(A) $\left|\sin \frac{\theta}{2}\right|$

(B) $\left|\cos \frac{\theta}{2}\right|$

(C) $\left|\tan \frac{\theta}{2}\right|$

(D) $\left|\cot \frac{\theta}{2}\right|$

12. $\hat{i}.(\hat{j}\times\hat{k})+\hat{j}.(\hat{k}\times\hat{i})+\hat{k}.(\hat{i}\times\hat{j})$ is equal to

(A) 0

(B) 1

(C) -1

(D) 3

13. The vector equation of a straight line passing through the point $\left(3\hat{i}-\hat{j}+\hat{k}\right)$ and parallel to the vector $\left(2\hat{i}+\hat{j}-4\hat{k}\right)$ is

(A) $\vec{r}=3\hat{i}-\hat{j}+\hat{k}+t\left(2\hat{i}+\hat{j}-4\hat{k}\right)$

(B) $\vec{r}=2\hat{i}+\hat{j}-4\hat{k}+t\left(3\hat{i}-\hat{j}+\hat{k}\right)$

(C) $\vec{r}=t\left(\hat{i}-2\hat{j}+5\hat{k}\right)$

(D) None of these

14. If $\vec{r}=\hat{i}\cos wt+\hat{j}\sin wt$, then which of the following statement is true ?

(A) $\frac{d^2\vec{r}}{dt^2}+2w^2\vec{r}=\vec{0}$

(B) $\frac{d^2\vec{r}}{dt^2}-2w^2\vec{r}=\vec{0}$

(C) $\frac{d^2\vec{r}}{dt^2}+w^2\vec{r}=\vec{0}$

(D) $\frac{d^2\vec{r}}{dt^2}-w^2\vec{r}=\vec{0}$

15. If $\vec{A}=2xz^2\hat{i}-yz\hat{j}+3xz^3\hat{k}$, then curl $\vec{A}$ equals to

(A) $x\hat{i}+y\hat{j}+z\hat{k}$

(B) $y\hat{i}+(4zx-3z^3)\hat{j}$

(C) $x\hat{i}+(4zx-3z^3)\hat{j}$

(D) $y\hat{j}+(4zx-3z^3)\hat{k}$

16. The transformed equation of the straight line $\frac{x}{a}+\frac{y}{b}=2$ when the origin is transferred to the point (a, b) is

(A) $\frac{x'}{a}+\frac{y'}{b}=2$

(B) $\frac{x'}{a}+\frac{y'}{b}=1$

(C) $x'+y'=ab$

(D) $\frac{x'}{a}+\frac{y'}{b}=0$

17. If $4xy+2x+2fy+3=0$ represents a pair of straight lines, then f equals to

(A) 1

(B) 2

(C) 3

(D) 4

18. The centre of the conic $ax^2+8xy-3y^2-4x+2y+c=0$ which passes through the points (0,0) and (1,0) will be

(A) $\left(-\frac{1}{14}, \frac{3}{7}\right)$

(B) $\left(\frac{1}{14}, \frac{3}{7}\right)$

(C) (1, 3)

(D) (14, 7)

19. The point on the conic $\frac{l}{r} = 1 - \cos\theta$ having the least radius vector is

(A) $\left(\frac{l}{2}, \pi\right)$

(B) $\left(\frac{l}{4}, \pi\right)$

(C) (l, π)

(D) $\left(\frac{l}{3}, \pi\right)$

20. The equation $7x^2 - 12xy + 5y^2 = 0$ represents

(A) two parallel lines

(B) a circle

(C) two perpendicular lines

(D) two lines through origin

21. If a line makes angles 35° and 55° with x-axis and y-axis respectively, then the angle which this line subtends with z-axis is

(A) 35°

(B) 45°

(C) 55°

(D) 90°

22. The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is

(A) 0°

(B) 90°

(C) 30°

(D) 45°

23. If the line $\frac{x - x_1}{l} = \frac{y - y_1}{m} = \frac{z - z_1}{n}$ is parallel to the plane $ax + by + cz + d = 0$, then

(A) $\frac{a}{l} = \frac{b}{m} = \frac{c}{n}$

(B) $\frac{a}{l} + \frac{b}{m} + \frac{c}{n} = 0$

(C) $al + bm + cn = 0$

(D) None of these

24. Spheres $x^2 + y^2 + z^2 + x + y + z - 1 = 0$ and $x^2 + y^2 + z^2 + x + y + z - 5 = 0$

(A) intersect in a plane

(B) intersect in five points

(C) do not intersect

(D) None of these

25. The equation of a plane which passes through $(2, -3, 1)$ and is normal to the line joining the points $(3, 4, -1)$ and $(2, -1, 5)$ is given by

(A) $x + 5y - 6z + 19 = 0$

(B) $x - 5y + 6z - 19 = 0$

(C) $x + 5y + 6z + 19 = 0$

(D) $x - 5y - 6z - 19 = 0$

26. $f(x)=\begin{cases}-1, & x<-1\\ -x, & -1\le x\le 1\\ 1, & x>1\end{cases}$ is continuous

(A) at $x = 1$ but not at $x = -1$

(B) at $x = -1$ but not at $x = 1$

(C) at both $x = 1$ and $x = -1$

(D) at none of $x = 1$ and $x = -1$

27. If the function $f(x) = x^3 - 6x^2 + ax + b$ satisfies Rolle's theorem in the interval $[1, 3]$ and $f'\left(\frac{2\sqrt{3}+1}{\sqrt{3}}\right)=0$, then

(A) $a = -11$

(B) $a = 11$

(C) $a = -6$

(D) $a = 6$

28. The function

$$f(x, y)=\begin{cases}1, & \text{if } x \text{ and } y \text{ are rational}\\ 0, & \text{otherwise}\end{cases}$$

is

(A) discontinuous at (0, 0)

(B) continuous at (0, 0)

(C) differentiable at (0, 0)

(D) None of these

29. The set $\left\{1, \frac{1}{2}, \frac{1}{3}, \ldots\ldots, \frac{1}{n}, \ldots\ldots\right\}$ has a limit point

(A) ∞

(B) 1

(C) 0

(D) None of these

30. The value of $\lim\limits_{x\to 1}\left[\frac{1}{\log x}-\frac{x}{\log x}\right]$ is equal to

(A) 0

(B) 1

(C) 2

(D) -1

31. The value of $\int_0^{2a}\frac{f(x)dx}{f(x)+f(2a-x)}$ is equal to

(A) $-a$

(B) a

(C) $-2a$

(D) 2a

32. If $I_n = \int_0^{\pi/4} \tan^n x\,dx$, then $I_{n+1} - I_{n-1}$ is equal to

(A) $\frac{\pi}{n}$

(B) $\frac{2\pi}{n}$

(C) $\frac{2}{n}$

(D) $\frac{1}{n}$

33. The integral $\int_0^1 \frac{dx}{x^{\frac{2}{3}}}$

(A) is divergent

(B) is convergent and its value is $\frac{2}{3}$

(C) is convergent and its value is 3

(D) None of these

34. The value of the integral $\int_0^{\infty} e^{-x^2} dx$ is equal to

(A) $\frac{1}{2}\sqrt{\pi}$

(B) $\sqrt{\frac{\pi}{2}}$

(C) $\sqrt{2\pi}$

(D) $2\sqrt{\pi}$

35. The area of the region bounded by the parabola $y^2 = 4x$ and its latus rectum is equal to

(A) $\frac{8}{3}$ sq. unit

(B) $\frac{3}{8}$ sq. unit

(C) 8 sq. unit

(D) 3 sq. unit

36. The equation of a curve passing through $\left(2, \frac{7}{2}\right)$ and having slope $1 - \frac{1}{x^2}$ at (x, y) is

(A) $y = x^2 + x + 1$

(B) $xy = x^2 + x + 1$

(C) $xy = x + 1$

(D) None of these

37. Integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

(A) $\cos x$

(B) $\tan x$

(C) $\sin x$

(D) $\sec x$

38. If $x\frac{dy}{dx}=y(\log y-\log x+1)$, then the solution of the equation is

(A) $\log\frac{y}{x}=cx$

(B) $\log\frac{y}{x}=cy$

(C) $\log\frac{x}{y}=cx$

(D) $\log\frac{x}{y}=cy$

39. The general solution of the differential equation $(\sin y + y\cos x)\,dx + (\sin x + x\cos y)\,dy = 0$ is

(A) $x\cos y+y\cos x=c$

(B) $x\sin x+y\cos y = c$

(C) $x\sin y+y\sin x=c$

(D) None of these

40. The particular integral of the differential equation $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=0$ is

(A) $6x^2e^{2x}$

(B) $3x^2e^{2x}$

(C) $4x^2e^{2x}$

(D) $2x^2e^{2x}$

41. Which of the following statement is not true ?

(A) Limit of a sequence, if exists, is unique.

(B) Every convergent sequence is bounded.

(C) Every cauchy sequence is bounded.

(D) The sequence $\{(-2)^n\}$ is a finitely oscillating sequence.

42. Which of the following statement is not true ?

(A) The sufficient condition for the convergence of the series Σu_n is that $\lim_{x\to\infty} u_n = 0$.

(B) If Σu_n and Σv_n are convergent then the series $\Sigma(u_n+v_n)$ is also convergent.

(C) If Σu_n and Σv_n are two series of non-negative terms and if $u_n \le v_n$ then the divergence of Σu_n implies the divergence of Σv_n.

(D) The series $\Sigma\frac{1}{n^p}$ is convergent for $p > 1$ and is divergent for $0 < p \le 1$.

43. The length of the subtangent to the curve $x^2+xy+y^2 = 7$ at $(1, -3)$ is

(A) 3

(B) 5

(C) 15

(D) $\frac{3}{5}$

44. If $y = f(x)$ is a function for which $\frac{dy}{dx}$ is equal to zero at a given point, then the function has necessarily its minimum value there, if at that point

(A) $\frac{d^2y}{dx^2} = 0$

(B) $\frac{d^2y}{dx^2} > 0$

(C) $\frac{d^2y}{dx^2} < 0$

(D) None of these

45. A particle thrown vertically upwards takes t secs to rise to a height h and t′ secs is the subsequent time to reach the ground again. Then h is given by

(A) $h = gtt'$

(B) $h = g(t+t')$

(C) $h = 2gtt'$

(D) $h = \frac{1}{2}gtt'$

46. If the tangential and normal acceleration of a particle moving in a plane curve are equal, then the velocity of the particle is given by

(A) $v = c\psi$

(B) $v = ce^{-\psi}$

(C) $v = ce^{\psi}$

(D) None of these

47. A particle is executing simple Harmonic motion such that its period of oscillation is π seconds. If its maximum acceleration is 8 ft/sec², then its amplitude is given by

(A) 2 ft

(B) 3 ft

(C) 4 ft

(D) 5 ft

48. For the set of equations

$3x_1 + 5x_2 - 7x_3 = 21$

$6x_1 + 10x_2 + 3x_3 = 42$

$x_1 = 2, \quad x_2 = 3, \quad x_3 = 0$

(A) is a basic feasible solution

(B) is a feasible solution but not a basic feasible solution

(C) is not a solution

(D) None of these

49. Which of the following statement is not correct ?

(A) The set of all convex combinations of a finite number of linearly independent vectors is a convex set.

(B) The intersection of two convex sets is also a convex set.

(C) The set of all feasible solutions to a linear programming problem is a closed convex set.

(D) A hyperplane is not a convex set.

50. The following linear programming problem

Maximize $Z = -x + 2y$

subject to $-x + y \leq 1$

$-x + 2y \leq 4$

$x, y \geq 0$

(A) has unbounded solution

(B) has no optimal solution

(C) has infinite number of solutions.

(D) None of these

51. Which of the following statements is not true ?

(A) Absolute sum of the deviation is minimum when it is measured from mean.

(B) The first moment about mean is always zero.

(C) If the distribution is symmetrical, the mean, median and mode coincide.

(D) Mode can be obtained from Histogram.

52. Which of the following statements is not true ?

(A) Regression coefficients are independent of the change of origin but not of scale.

(B) The covariance, the coefficient of correlation and the two regression coefficients have the same sign.

(C) When two variables are independent, they are uncorrelated.

(D) Regression lines of y on x and x on y do not intersect at all.

53. For a stochastic variate X, variance is given by

(A) $V(X) = (E(X))^2 - E(X^2)$

(B) $V(X) = E(X^2) - (E(X))^2$

(C) $V(X) = E(X^2) - 1$

(D) None of these

54. There are q persons sitting in a row. Two of them are selected at random. The probability that the two selected persons are not together is

(A) $\frac{2}{q}$

(B) $1 - \frac{2}{q}$

(C) $\frac{q(q-1)}{(q+1)(q+2)}$

(D) None of these

55. The probability density function f(x) of a continuous random variable is defined by

$f(x) = \frac{A}{x^3}, \quad 5 \le x \le 10$

$= 0, \quad$ elsewhere

The value of A is

(A) 50

(B) 1

(C) – 200

(D) $\frac{200}{3}$

56. Which of the following statement is not correct ?

(A) Sum of two independent normal variate is not a normal variate.

(B) For a normal distribution, mean = median = mode.

(C) If X is a normal variates 4X+5 would also be a normal variate.

(D) Normal curve is bell shaped symmetrical about mean.

57. If f(x) has probability density $3x^2$, $0 \le x \le 1$, then $P\left(\frac{1}{3} < x < \frac{1}{2}\right)$ is equal to

(A) 1

(B) $\frac{91}{216}$

(C) $\frac{19}{216}$

(D) $\frac{78}{216}$

58. Which of the following statement is correct ?

(A) $\nabla = 1 - E^{-1}$

(B) $\nabla = \Delta^{-1}$

(C) $\nabla = E - \Delta$

(D) $\nabla = E + \Delta$

59. Interpolation formulae will give better result if the function is

(A) logarithmic

(B) exponential

(C) polynomial

(D) trigonometric

60. Numerical integration gives

(A) only the approximate value of the definite integral

(B) only the exact value of the definite integral

(C) neither the approximate nor the exact value of the definite integral

(D) None of these.

(Space for rough work)